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Description

This invention relates to raster input scanners and, more particularly, to a system for calibrating a raster input scanner, and also to a method of calibrating such a system.

Raster input scanning technology has progressed rapidly in recent years, particularly in data entry applications. With the scanning arrays longer, and comprised of greater numbers of photosites than ever before requiring only a single array to read the sagittal (x axis or fast scan direction) of the document, scanning speeds have greatly increased. The entry of data to data processing systems through raster input scanning devices has become an attractive goal.

While data processing and scanning arrays have become substantially less expensive, the exacting mechanical alignment required for the scanning arrays and optics remains a significant cost factor in the construction of raster input scanning devices. Without exact mechanical positioning of the scanning arrays with respect to the optical system and input information handling devices, the scanner is inexact, and data errors may result. While a well constructed device may be aligned to within a few tenths of a percent of the desired position, a careless alignment will cause significant problems. As an example, a photosite array housing and support may require several adjustments, including adjustments to slow scan (y-axis) and fast scan direction, tilt, magnification, focus and height requiring separate parts adjustable in each direction. Even with excellent factory quality controls, disturbance in the field may ruin a careful factory alignment. A self aligning device operative to avoid certain of these mechanical adjustments would improve this problem significantly.

US-A- 4,149,091 describes a system for aligning a plurality of offset and overlapping arrays by measuring and storing information in a device memory regarding the array positions with respect to each other, and using the stored information as offset values in processing the data entered into a processing system through the raster input scanner. The information regarding the position of the sensor arrays necessary for this system is acquired by microscopically measuring the arrays and storing the information in a memory as a vernier scale which tells the scanning device when to switch from array to array.

The Xerox Disclosure Journal "Raster Scanner Alignment Techniques", Vol. 5, No. 3 (May/June 1980) appears to show a calibration method for determining offsets required to correct misalignment. The y-axis is adjusted by choosing the array offsets along the y-axis, and the x-axis is adjusted by choosing the bit offsets along the x-axis. The primary thrust of the discussion relates to the provision of a particular type of test document for improved calibration use.

Japanese Patent Document JP-A-59-63873 provides a picture input device in which a rotary encoder integrally mounted with the line sensor is used as a range finder whereby for each movement of the line sensor a predetermined distance a pulse is directed to a controller.

US-A-4 605 970 describes a document digitizer comprising a rotatable drom on which a document to be scanned is mounted, and a scanning array which moves lengthwise of the drum in steps. A calibration strip is also mounted on the drum, extending parallel to the drum axis. The calibration strip carries an optically-detectable pattern including a series of discrete blocks which provide first and second orthogonal edges respectively parallel to, and transverse to, the direction of movement of the scanning array. The first edges are used as a reference location around the surface of the drum as the drum rotates during scanning, while the second edges are used when the drum is stationary to calibrate the stepwise movement of the scanning array.

The invention claimed herein provides a method and apparatus for self alignment of a raster input scanner. An image scanning device is provided with a linear photoelectric sensor array for detecting image information on a preselected surface, the array comprising a plurality of discrete photosensitive elements arranged along a first axis (x) for sensing and generating electrical representations of the image information on a surface; a carriage assembly movable along a second axis (y), transverse to said first axis, and supporting a sensor detectable calibration target for movement therealong; a drive system for driving the carriage assembly from a starting position along the second axis; measuring means for measuring the distance traveled by the carriage from the starting position until an alignment feature on the calibration target is sensed; and a y-axis memory means for storing a value indicative of said measured distance for use as a y-axis offset value. In operation, the carriage assembly carrying a calibration target is moved along the second axis from a preselected position. The sensors in the array detect the alignment feature of the target, whereupon the distance traveled by the carriage from the starting point along the y-axis until the sensors detect the alignment feature on the calibration target is measured. This distance may be compared to a stored theoretical or reference value representing the distance from the home position that the feature should be located, based on known dimensions of the aperture card, calibration target, and alignment feature. The comparison between the theoretical value

and the measured value is stored in a memory for use by image processing systems as a y- axis offset value enabling an image signal to be produced from which the effect of that offset has been eliminated thereby calibrating the scanning device along the y-axis.

In accordance with another aspect of the present invention, an x-axis offset value is derived by sensing the alignment feature on the calibration target, and determining its position with respect to the linear sensor array. This position may then be compared to a reference value stored in a device memory and the results used as an x-axis offset by the imaging processing system in processing the electrical representations generated by the sensor array thereby calibrating the scanning device along the x-axis. Alternatively, an offset value may be derived for either or both axes using a similar procedure.

In accordance with yet another aspect of the invention, a magnification offset value is derived by comparing the position of a magnification feature on the target with a desired position for the feature, determining a magnification ratio based on the comparison, and storing that ratio as a magnification constant. The electrical representations generated by the sensor array may then also be processed in accordance with that stored magnification constant to calibrate magnification in the scanning device.

The scanning device may include a light source for illuminating the sensor detectable target, and a focusing lens for focusing light from the target on the sensor array, said lens being movable to vary the forms of the light rays. In accordance with still another aspect of the invention, a focus offset value may be provided by sensing a focusing feature on the target, determining the best focus by moving the lens with respect to the target, and storing the best focus position as a focus offset value. The scanning device may include means for moving the lens to the stored position to calibrate focus in the device.

The above described invention provides the advantage of reducing substantially the requirements of mechanical alignment. By providing alignment electronically, alignment operations can be reduced to fitting the photosite array housing and support as a single unitary member, reducing the cost of manufacture, and eliminating further adjustment requirements.

With offset values determined electronically, the values may be used in a number of ways. Thus, for example, the raster input scanner can ignore or discard information from scanned area on the aperture card film surface between the mechanical origin or starting point in the y-direction, and the point at which the calibration process has determined the image information on the film held in the aperture card should begin. In a like manner, in the x direction, an excess number of photosites on either end of the photosite array can be discarded or ignored. The raster input scanner "reads" only that portion of the subsequent image information on the aperture card film presented for entry to the data processing falling within a window determined to represent a centered image. Thus, the image information is centered with respect to the system. As a diagnostic tool, by reviewing the programmed alignment, large scale defects may be remedied, such as when either the x- or y- axis discards too great a portion of the image field. The stored magnification and focus values aid in allowing a return of the machine to nominal operating values after the occurrence of a disturbing condition, repair, movement of the device, etc. In the case of magnification, the stored magnification information enables certain interpolation routines used to provide a magnification of the information detected on the original scanned.

The arrangement also provides information to the control electronics for processing detected image information by providing the appropriate electronic information such as x-and y-offset values for such further image handling requirements as cropping or windowing, and scaling or magnification.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a somewhat schematic view of a raster input scanner for scanning a transmissive original, of the type contemplated to incorporate the present invention;

FIGURE 2 is a a block diagram demonstrating the operational elements of a preferred embodiment of the present invention;

FIGURE 3 shows a calibration target including alignment features in accordance with a preferred embodiment of the invention; and

FIGURE 4 graphically illustrates the x direction alignment, and magnification adjustment.

Referring now to the drawings, wherein the showings are for the purpose of illustrating an embodiment of the invention and not for the purpose of limiting same, FIGURE 1 shows, somewhat schematically, an arrangement for a raster input scanner 10 of the type contemplated to incorporate the present invention and adapted for scanning image information from a transmissive original, such as an aperture card 12 with sensor array 40. Raster input scanner 10 is of a type well known in the art. A raster input scanner of the type contemplated may be generally comprised of light source 16, comprised of reflector 20, lamp 22, condenser 24, filter 26 and lens 28, for illuminating image information printed on high quality photo-

graphic film and held in aperture card 12. Aperture card 12 is held in position for scanning by card holder 30. Card holder 30 is mounted on slide 32 for reciprocal movement in a horizontal direction along the y-axis, which in FIGURE 1 is perpendicular to the plane of the drawing. A drive motor 34 imparts motion to the card holder 30 via precision lead screw drive 36 (best seen schematically in FIGURE 2), whereby card holder 30 is moved along slide 32 carrying aperture card 12 therewith Movement along slide 32 comprises motion in the slow scan y direction, indicated by the arrow 37.

The image formed by light passing through the film held by aperture card 12 is focused on sensor 40 mounted on sensor board 42, through lens 44. As shown in Figure 2, lens 44 may also be supported for movement along a slide (not shown) towards and away from sensor array 40, as indicated by arrow 47, driven by lens motor 45 via precision lead screw drive 39 to allow focusing of the optical arrangement. Magnification of the image may be possible with magnification adjustment 46, in addition to or if electronic magnification adjustment is not provided. Sensor 40, as contemplated in the present invention, may be comprised of a linear array of photosites extending in the x (fast scan) direction (best shown in FIGURE 4) such as, for example, CCD's which detect light striking the sensor array through the image information on the film held in aperture card 12. In a preferred embodiment, the length of the sensor array 40 may correspond to the x direction length of the film held in aperture card 12 providing a 1:1 correspondence in size between the image information on the film in aperture card 12 and the image focused on sensor array 40, and may be comprised of about approximately 5900 discrete photosites. It will be appreciated as an alternative that the described array may be smaller or larger than the image information on the film in aperture card 12, in which case the image may be magnified to be commensurate with the length of the array. As yet another alternative, the sensor may be a two dimensional array, extending in both x and y directions. In such an arrangement, the sensor detects the image of a selected two dimensional area. The two dimensional sensor may be large enough, i.e. provide satisfactory resolution to provide sensing of the entire image area simultaneously, or require movement of the image with respect to the array to derive a series of images. The photosites are "exposed" to light from the image in preset time increments or integration periods during which a charge proportional to the light detected from a narrow bit of a slice of the image projected on array 40 is generated at each photosite. Following integration, the charges derived at the photosites are moved to image processor 50 for data manipulation and output.

Referring to FIGURE 2, carriage motor 34 may advantageously be a stepping motor controlled by motor drive controller 51 with a technique called microstepping provided to allow the motor revolutions to be divided into a large number of steps, each step providing an exact increment of linear movement of lead screw 36, and accordingly aperture card 12. Accordingly, the image is advanced across the array 40 incrementally, step-by-step as motor drive controller 51 delivers control pulses to the motor in accordance with operation of the device. A D.C. motor may also be used, coupled with an encoder arrangement providing a signal indicative of the position of the lens or carriage, based on operation of the motor. Similarly, lens motor 45 may advantageously be a stepper motor or a D.C. motor suitable for controllably driving the lens towards and away from the sensor array 40, controlled in a similar manner by motor drive controller 51. Movement of the lens thereby varies the focus of the device.

Microprocessor controller 52 controls the sequence of events in the raster input terminal. This electronic controller is comprised of a suitable CPU chip such as an Intel Model 8085 CPU chip manufactured by Intel Corporation. The CPU is provided with a diagnostic memory means 54 storing necessary calibration information, such as the characteristic features of the calibration images to be detected and theoretical or reference locations of particular selected features on the calibration target, i.e. where in a perfectly aligned arrangement the features should be detected, and a nonvolatile RAM calibration memory 56 to receive the information acquired or derived during the calibration procedure for storage and subsequent use by microprocessor controller 52 during normal data input operations. The use of a volatile RAM calibration memory, while satisfactory for operation of the device, will require recalibration of the device each time the machine is powered up.

In operation, light from lamp 22 passes through the photographic film contained within aperture card 12, creating an image of whatever is disposed on the film for detection by CCD array 40. CCD array 40 is exposed to a sequence of narrow slices of the image, each for a preselected integration period, during which time packets of charge are created at the photosites comprising the array. The charge packets are passed to image processor 50 where analog values derived by the sensors are converted to digital signals suitable for use by standard microprocessors. The digital signal is subsequently passed to an image feature correction processor 58 which utilizes information from microprocessor controller 52 to correct the image by centering, magnifying, cropping, scaling, etc in ac-

cordance with operating characteristics or user selectable features of the raster input scanner, as programmed or selected through microprocessor controller 52. The processed signal is then sent to output 60 from where the signal may be sent to appropriate data utilization devices, such as printers, telecommunication devices, computer workstations, etc. The above described arrangement is well known in the art.

As shown in FIGURE 3 and in accordance with the invention, the film contained within aperture card 12 is provided with a calibration target 62. In a preferred embodiment, calibration target 62 may be comprised of several vertical, horizontal and skewed lines, and a variety of geometric shapes useful for calibration of adjustable features of the system, including a butterfly shape 70 comprised of two generally similar triangular shapes having apexes joined at a point I centrally located proximate to the center of target and film, and having the apexes oriented and pointing along a line parallel to the axis of travel (y-axis) of the calibration target. It will be appreciated that the calibration target as shown in FIGURE 3 is but one possible embodiment. Almost any arrangement providing distinguishable and detectable features would be suitable for use.

Referring to FIGURES 1, 2 and 3, card carriage 32 is moved to a mechanical home position as a starting point. When home switch 62 is enabled by the presence of the card carriage at the home position, a counter in microprocessor controller 52 is set to a zero point or origin. When calibration of the device is required, the slow scan drive is enabled and the carriage 30 supporting the calibration target 62 is driven along the y-axis across the field of view of the sensor array 40 by motor 34 via lead screw drive 36. The pulses required to drive the motor 34 increment the microprocessor counter, as indications of movement and thus, measurement of movement along the y-axis. The image information-supporting film is moved across the field of vision of the photodetector array 40, which detects image information thereon, transmitting the signals derived at the array 40 to image processor 50. Image processor 50 forwards the information derived at the photosites to microprocessor controller 52 for comparison to stored calibration information in diagnostic memory 54. In the present embodiment, the y-axis calibration point is the point I at which the apexes of the butterfly shape 70 meet. On a positive comparison with the information stored in diagnostic memory 54, whereby detection of the feature is determined, the number of pulses from the motor drive controller 51 counted by microprocessor controller 52 is compared to a reference value stored in diagnostic memory 54, and the comparison, indicative of the distance difference along the y-axis between the sensed position of the feature and the reference value representing a desired or theoretical position of the feature is stored as an offset value at calibration memory 56. Knowledge of the difference between reference value and sensed value enables the microprocessor controller 52 to determine the actual starting point of the image information on aperture card 12. Thus the offset allows the processor to ignore or discard excess data received during y-axis scanning as determined by the y-axis offset value.

In a similar manner, a focus offset value may be derived and stored. A selected feature is detected, chosen from the calibration target 62, such as the butterfly feature 70. The calibration target 62 is scanned in the same manner as described with respect to the y-axis offset value determination until this feature is found by a process of comparison to stored information at diagnostic memory 54. At this point the features are compared with memory to determine whether the detected image occludes an appropriate number of sensors. Focus is a function of obtaining the greatest intensity of the image over the minimum number of sensors. To determine whether the device is at a best focus position, the lens motor, initially placed at a known mechanical home position, incrementally drives the lens either closer to or further away from the target image. A sensing routine detects the intensity and number of pixels occluded at each incremental position until a best value is found. Microprocessor controller 52 stores the position the lens of the best focus value detected until a better focus is detected at a new lens position. The best focus position is stored in the calibration memory 56 as the focus offset value. Thereafter, during a calibration routine, the lens may be moved form the mechanical home position to the best focus position, as part of the alignment process.

To determine the x-axis offset value, a selected feature is chosen from the calibration target 62 from which an x-axis offset value will be determined. In a preferred embodiment of the invention, the selected feature may again be the point I at which the apexes of the triangles forming butterfly shape 70 are joined. The calibration target 62 is scanned in the same manner as described with respect to the y-axis offset value determination until this feature is found by a process of comparison to the stored information at diagnostic memory 54. When the point I is found by the scanning process, its position with respect to the array of photosites is measured. For example, as shown in Figure 4, the point I is detected by the sensor array 40. The feature may be detected by identifiable discrete photosensors, e.g. photosite sensor element 2730. By comparing the position of the photosites at which the feature is actually sensed to an x-axis reference stored in diagnostic memory

54, indicative of the position of the photosites sensor where the value should have been sensed, e.g. photosite sensor element 2950, it can be seen that the point I is displaced from its desired position by a distance corresponding to about approximately 220 photosites. In accordance with this determination, it may be appreciated that an x-axis offset value may be entered into the calibration memory which effectively discards or ignores the data received from photosites 1 to 220 on the array. In this manner, the x-axis is effectively centered with respect to the sensor array 40 since identical amounts of data on either side of the centerline 2950 will be measured.

As an alternative method of detecting the x-axis offset value, and in accordance with the present invention, a line extending along the x-axis may be sensed, and its position measured with respect to the ends of the array. Thus, if a line has a known length which would be detected by a a selected number of photosites, the position of the end points of the line with respect to the endpoints of the array may be compared with stored values for the same distances. Accordingly, detecting a greater value for these distances than that stored in the diagnostic memory 54 would require the discarding of the data from the excess photosites, which is stored in the calibration memory for use by the microprocessor controller 52. Magnification is also determinable from this information. A feature is detected as described, and a comparison is made between the detected position and the desired position. Based on this comparison, a number of desired data points is determined. If the number of desired data points is greater that the number of photosites available, an interpolation routine is used to create a larger number of data points, according to a "nearest neighbor" or an average of adjacent points. This new data will be the output image data. The number of points derived from the comparison of the detected value with the desired value may be stored as a magnification offset, which will serve to provide desired magnification whenever the device is used. For example, if a selected feature such as the point I is detected by 10 photosites, but desired to be detected by 12 photosites, a value stored in diagnostic memory 54, a magnification flaw is determined. The device will store a magnification offset ratio of 1:1.2, a ratio corresponding to the desired magnification offset, in calibration memory 56. Then, the device will perform an interpolation routine for every operation to produce the required 600 more data points. In a typical interpolation routine, this would include generating data for a multiple of the actual (detected) data points, and selecting a number of this multiple corresponding to the desired final number of data points. Thus, the desired number of data points would be provided.

It will be appreciated that while the present invention is described with respect to use in an arrangement suitable for scanning image information on aperture cards, the invention would find use in almost any raster scanning input device. Accordingly, in a device for scanning image information on the surface of an opaque sheet of paper or other substrate, the calibration target could be supplied in a suitable format, e.g. an opaque substrate suitable for scanning by the chosen device, or permanently embedded on the platen or platen cover. The remainder of the device would remain substantially the same using the scanning and data handling arrangements existing in such device.

Claims

1. A raster input scanning device for detecting an image on a preselected surface, including:

   a carriage assembly (30) for supporting the said image;

   a linear photoelectric sensor array (40) comprising a plurality of discrete photosensitive elements arranged for sensing the image (12) supported by the carriage assembly and generating electrical representations thereof;

   a sensor detectable target (62), supported by the carriage assembly, which includes an alignment feature (70) for use during calibration operations;

   a drive (34) for driving said carriage assembly; and

   a system for calibrating the scanning device;

   characterized in that:

   the photosensitive elements of the sensor array are arranged along a first axis (x) and the carriage assembly is movable by the said drive along a second axis (y) transverse to the first axis; and

   the calibrating system comprises: means (51, 52) for measuring the distance travelled by the carriage, from a starting position, along the second axis until said alignment feature on said target is sensed by the sensor array; means (52, 54) for comparing the measured distance with a reference to determine an offset value for the second axis; a memory (56) for storing that offset value; and means [50, 58] for processing the electrical representations, generated by the sensor array, in accordance with the stored offset value for the second axis to produce an image signal from which the effect of that offset has been eliminated thereby calibrating the scanning device along the second axis.

2. A scanning device as claimed in claim 1, wherein said sensor detectable target is a test target removable from said carriage.

3. A scanning device as claimed in claim 1 or claim 2, wherein the calibrating system includes means for detecting the position of the said alignment feature with respect to the length of the sensor array (Fig. 4), and means for comparing the detected position with a reference to determine an offset value for the first axis for storage in the said memory whereby the electrical representations generated by the sensor array are also processed in accordance with that stored offset value to calibrate the scanning device along the first axis.

4. A scanning device as claimed in any preceding claim, further comprising:

a motor drive controller (51) producing a series of control signals for controlling said drive system;

a diagnostic memory (54) for storing reference information representative of the alignment feature and the desired location thereof; and

a system controller (52) for comparing images detected by said photosensitive elements with said stored reference information to identify the detection of the alignment feature by the sensor array, wherein the system controller receives said control signals from said motor drive controller and thereby measures the distance travelled by the carriage until said alignment feature on said target is sensed by the sensor array.

5. A scanning device as claimed in any preceding claim, wherein the sensor detectable target includes a magnification feature for use during calibration operations, and the calibrating system comprises:

means for determining the number of photosensitive elements detecting said magnification feature; and means for comparing the actual number of photosensitive elements detecting said magnification feature with a reference value to determine a magnification constant for storage in the said memory whereby the electrical representations generated by the sensor array are also processed in accordance with that stored magnification constant to calibrate magnification in the scanning device.

6. A scanning device as claimed in any preceding claim, comprising a light source (16) for illuminating the sensor detectable target, and a focusing lens (44) for focusing light from said target on said sensor array, said lens being movable to vary the focus of the light rays; wherein the sensor detectable target includes a focus feature for use during calibration operations and the calibrating system comprises:

means for determining the number of sensors detecting said focus feature, and the intensity of light from said detected feature as an indication of focus at any selected position; a temporary memory for storing focus indications at successive selected positions of said focusing lens between said sensor array and said target image to determine the position deriving the optimum focus indication for storage in the said memory, and means for moving the lens to the stored position to calibrate focus in the scanning device.

7. A method of calibrating a raster input scanning device for detecting an image on a preselected surface, the scanning device comprising a carriage assembly (30) for supporting the said image; a linear photoelectric sensor array (40) comprising a plurality of discrete photosensitive elements arranged along a first axis for sensing the image (12) supported by the carriage assembly and for generating electrical representations thereof; and a sensor detectable target (62), supported by the carriage assembly, which includes an alignment feature (70) for use during alignment operations; the method being characterized by the steps of:

moving the carriage assembly along a second axis transverse to the first axis;

measuring the distance travelled by the target, from a starting point, along the second axis until the sensors detect the said alignment feature;

comparing the measured distance with a reference value;

storing a value representative of said distance comparison in a memory; and

processing the electrical representations, generated by the sensor array, in accordance with the stored value to produce an image signal from which the effect of that offset has been eliminated to calibrate the scanning device along the second axis.

8. A method as claimed in claim 7, and including the steps of:

detecting the position of an alignment feature with respect to the length of said array of photosensitive sensors;

comparing said detected position with a reference;

storing a value representative of said posi-

tion comparison in said memory;

using said stored value as a first axis offset reference, whereby the electrical representations generated by the sensor array are also processed in accordance with that stored offset value to calibrate the scanning device along the first axis.

Patentansprüche

1. Eine Rastereingabeabtasteinrichtung zum Erfassen eines Bildes auf einer vorbestimmten Oberfläche, die einschließt:

   eine Vorschubeinrichtung (30) zum Halten des genannten Bildes;

   eine lineare, photoelektrische Meßfühlergruppierung (40), die eine Mehrzahl einzelner, lichtempfindlicher Elemente umfaßt, die zum Erfassen des Bildes (12), das von der Vorschubeinrichtung gehalten ist, und zum Erzeugen elektrischer Darstellungen von diesem angeordnet sind;

   ein von der Vorschubeinrichtung gehaltenes, von einem Meßfühler erfaßbares Ziel (62), das ein Ausrichtungsmerkmal (70) zur Verwendung während Eichvorgängen einschließt;

   einen Antrieb (34) zum Antreiben der genannten Vorschubeinrichtungen; und

   ein System zum Eichen der Abtasteinrichtung; dadurch gekennzeichnet, daß

   die lichtempfindlichen Elemente der Meßfühlergruppierung längs einer ersten Achse (X) angeordnet sind und die Vorschubseinrichtung durch den genannten Antrieb längs einer zweiten Achse (Y) quer zu der ersten Achse bewegbar ist; und

   das Eichsystem umfaßt: eine Einrichtung (51, 52) zum Messen der von dem Vorschub von einer Startposition längs der zweiten Achse zurückgelegten Strecke bis das genannte Ausrichtungsmerkmal auf dem genannten Ziel von der Meßfühlergruppierung erfaßt wird; eine Einrichtung (52, 54) zum Vergleichen der gemessenen Strecke mit einem Bezug, um einen Versetzungswert für die zweite Achse zu bestimmen; einen Speicher (56) zum Speichern dieses Versetzungswertes; und eine Einrichtung (50, 58) zum Verarbeiten der durch die Meßfühlergruppierung erzeugten, elektrischen Darstellungen gemäß dem gespeicherten Versetzungswert für die zweite Achse, um ein Bildsignal zu erzeugen, von dem die Wirkung der Versetzung entfernt worden ist, wodurch die Abtasteinrichtung längs der zweiten Achse geeicht wird.

2. Eine Abtasteinrichtung, wie in Anspruch 1 beansprucht, wobei das genannte von einem Meßfühler erfaßbare Ziel ein von dem genannten Vorschub entfernbares Prüfziel ist.

3. Eine Abtasteinrichtung, wie in Anspruch 1 oder Anspruch 2 beansprucht, wobei das Eichsystem eine Einrichtung zum Erfassen der Position des genannten Ausrichtungsmerkmals in bezug auf die Länge der Meßfühlergruppierung (Fig. 4) und eine Einrichtung zum Vergleichen der erfaßten Position mit einem Bezug einschließt, um einen Versetzungswert für die erste Achse zum Speichern in dem genannten Speicher zu bestimmen, wodurch die von der Meßfühlergruppierung erzeugten, elektrischen Darstellungen auch in Übereinstimmung mit diesem gespeicherten Versetzungswert verarbeitet werden, um die Abtasteinrichtung längs der ersten Achse zu eichen.

4. Eine Abtasteinrichtung, wie in einem beliebigen vorhergehenden Anspruch beansprucht, ferner umfassend:

   eine Motorantriebssteuereinrichtung (51), die eine Reihe von Steuersignalen zum Steuern des genannten Antriebssystems erzeugt;

   einen Diagnosespeicher (54) zum Speichern von Bezugsinformationen, die das Ausrichtungsmerkmal und dessen erwünschte Lage darstellen; und

   eine Systemssteuereinrichtung (52) zum Vergleichen von durch die genannten lichtempfindlichen Elemente erfaßten Bildern mit den genannten gespeicherten Bezugsinformationen, um die Erfassung des Ausrichtungsmerkmals durch die Meßfühlergruppierung zu identifizieren, wobei die Systemssteuereinrichtung die genannten Steuersignale von der genannten Motorantriebssteuereinrichtung empfängt und dadurch die von dem Vorschub zurückgelegte Strecke mißt, bis das genannte Ausrichtungsmerkmal auf dem genannten Ziel von der Meßfühlergruppierung erfaßt wird.

5. Eine Abtasteinrichtung, wie in einem beliebigen vorhergehenden Anspruch beansprucht, wobei das von einem Meßfühler erfaßbare Ziel ein Vergrößerungsmerkmal zur Verwendung während Eichvorgängen einschließt und das Eichsystem umfaßt:

   eine Einrichtung zum Bestimmen der Anzahl von lichtempfindlichen Elementen, die das genannte Vergrößerungsmerkmal erfassen; und eine Einrichtung zum Vergleichen der gegenwärtigen Anzahl von lichtempfindlichen Elementen, die das genannte Vergrößerungsmerkmal erfassen, mit einem Bezugswert, um eine Vergrößerungskonstante zum Speichern in dem genannten Speicher zu bestimmen, wo-

durch die von der Meßfühlergruppierung erzeugten, elektrischen Darstellungen ebenfalls in Übereinstimmung mit dieser gespeicherten Vergrößerungskonstanten verarbeitet werden, um die Vergrößerung in der Abtasteinrichtung zu eichen.

6. Eine Abtasteinrichtung, wie in einem beliebigen vorhergehenden Anspruch beansprucht, umfassend eine Lichtquelle (16) zum Beleuchten des von einem Meßfühler erfaßbaren Ziels und eine Fokussierungslinse (44) zum Fokussieren von Licht von dem genannten Ziel auf die genannte Meßfühlergruppierung, wobei die genannte Linse bewegbar ist, um den Brennpunkt der Lichtstrahlen zu verändern; wobei das von einem Meßfühler erfaßbare Ziel ein Fokussierungsmerkmal zur Verwendung während Eichvorgängen einschließt und das Eichsystem umfaßt:

   eine Einrichtung zum Bestimmen der Anzahl von Meßfühleren, die das genannte Fokussierungsmerkmal erfassen, und der Lichtintensität von dem genannten erfaßten Merkmal als eine Fokussierungsanzeige an irgendeiner ausgewählten Position; einen Zwischenspeicher zum Speichern von Fokussierungsanzeigen an aufeinanderfolgenden, ausgewählten Positionen der genannten Fokussierungslinse zwischen der genannten Meßfühlergruppierung und dem genannten Zielbild, um die Position, die die optimale Fokussierungsangabe ableitet, zum Speichern in dem genannten Speicher zu bestimmen, und eine Einrichtung zum Bewegen der Linse in die gespeicherte Position, um die Fokussierung in der Abtasteinrichtung zu eichen.

7. Ein Verfahren zum Eichen einer Rastereingabeabtasteinrichtung zum Erfassen eines Bildes auf einer vorbestimmten Oberfläche, wobei die Abtasteinrichtung umfaßt:eine Vorschubeinrichtung (30) zum Halten des genannten Bildes; eine lineare, photoelektrische Meßfühlergruppierung (40), die eine Mehrzahl einzelner, lichtempfindlicher Elemente umfaßt, die zum Erfassen des Bildes (12), das von der Vorschubeinrichtung gehalten ist, und zum Erzeugen elektrischer Darstellungen von diesem längs einer ersten Achse angeordnet ist; ein von der Vorschubeinrichtung gehaltenes, von einem Meßfühler erfaßbares Ziel (62), das ein Ausrichtungsmerkmal (70) zur Verwendung während Ausrichtungsvorgängen einschließt; wobei das Verfahren gekennzeichnet ist durch die Schritte:

   Bewegen der Vorschubeinrichtung längs einer zweiten Achse quer zu der ersten Achse;

   Messen der von dem Ziel von einem Startpunkt längs der zweiten Achse zurückgelegten Strecke bis die Meßfühler das genannte Ausrichtungsmerkmal erfassen;

   Vergleichen der gemessenen Strecke mit einem Bezugswert;

   Speichern eines Wertes, der für den genannten Streckenvergleich repräsentativ ist, in einem Speicher; und

   Verarbeiten der durch die Meßfühlergruppierung erzeugten, elektrischen Darstellungen in Übereinstimmung mit dem gespeicherten Wert, um ein Bildsignal zu erzeugen, von dem die Wirkung dieser Versetzung entfernt worden ist, um die Abtasteinrichtung längs der zweiten Achse zu eichen.

8. Ein Verfahren, wie es in Anspruch 7 beansprucht ist und die Schritte einschließt:

   Erfassen der Position eines Ausrichtungsmerkmals in bezug auf die Länge der genannten Gruppierung von lichtempfindlichen Meßfühlern;

   Vergleichen der genannten erfaßten Position mit einem Bezug;

   Speichern eines Wertes, der für den genannten Positionsvergleich repräsentativ ist, in dem genannten Speicher;

   Verwenden des genannten gespeicherten Wertes als ein Versetzungsbezug der ersten Achse, wobei die durch die Meßfühlergruppierung erzeugten, elektrischen Darstellungen ebenfalls in Übereinstimmung mit diesem gespeicherten Versetzungswert verarbeitet werden, um die Abtasteinrichtung längs der ersten Achse zu eichen.

Revendications

1. Dispositif d'analyse de trame d'entrée pour détecter une image sur une surface présélectionnée, comportant :

   un ensemble chariot (30) pour supporter ladite image ;

   un réseau de capteurs photo-électriques linéaire (40) comprenant une multitude d'éléments photosensibles discrets disposés pour détecter l'image (12) supportée par l'ensemble chariot et produisant des représentations électriques de celle-ci ;

   une cible détectable par capteur (62) supportée par l'ensemble chariot, qui comporte une caractéristique d'alignement (70) pour utilisation pendant les opérations d'étalonnage ;

   un dispositif d'entraînement (34) pour entraîner ledit ensemble chariot, et

   un système pour étalonner le dispositif d'analyse ;

caractérisé en ce que :

les éléments photosensibles du réseau de capteurs sont disposés suivant un premier axe (x) et l'ensemble chariot peut être déplacé par le dispositif d'entraînement suivant un second axe (y) transversal au premier axe, et

le système d'étalonnage comprend des moyens (51, 52) pour mesurer la distance parcourue par le chariot, à partir d'une position de départ suivant le second axe jusqu'à ce que la caractéristique d'alignement sur la cible soit détectée par le réseau de capteurs ; des moyens (52, 54) pour comparer la distance mesurée à une référence afin de déterminer une valeur de compensation pour le second axe ; une mémoire (56) pour mémoriser cette valeur de compensation ; et des moyens (50, 58) pour traiter les représentations électriques produites par le réseau de capteurs en conformité avec la valeur de compensation mémorisée pour le second axe afin de produire un signal d'image à partir de laquelle l'effet de ce décalage a été éliminé, étalonnant de ce fait le dispositif d'analyse suivant le second axe.

2. Dispositif d'analyse selon la revendication 1, dans lequel ladite cible détectable par capteur est une cible de test enlevable du chariot.

3. Dispositif d'analyse selon la revendication 1 ou la revendication 2, dans lequel le système d'étalonnage comporte des moyens pour détecter la position de la caractéristique d'alignement par rapport à la longueur du réseau de capteurs (figure 4), et des moyens pour comparer la position détectée à une référence afin de déterminer une valeur de compensation pour le premier axe pour mémorisation dans la mémoire, d'où il résulte que les représentations électriques produites par le réseau des capteurs sont également traitées en conformité avec cette valeur de compensation mémorisée pour étalonner le dispositif d'analyse suivant le premier axe.

4. Dispositif d'analyse selon l'une quelconque des revendications précédentes, comprenant de plus :

un contrôleur d'entraînement du moteur (51) produisant une série de signaux de commande pour commander le système d'entraînement ;

une mémoire de diagnostic (54) pour mémoriser des informations de référence représentatives de la caractéristique d'alignement et de l'emplacement désiré de celle-ci, et

un contrôleur système (52) pour comparer les images détectées par les éléments photosensibles aux informations de référence mémorisées pour identifier la détection de la caractéristique d'alignement dans le réseau de capteurs, dans lequel le contrôleur système reçoit les signaux de commande à partir du contrôleur d'entraînement du moteur et mesure de ce fait la distance parcourue par le chariot jusqu'à ce que la caractéristique d'alignement sur la cible soit détectée par le réseau de capteurs.

5. Dispositif d'analyse selon l'une quelconque des revendications précédentes, dans lequel la cible détectable par capteur comporte une caractéristique de grossissement pour utilisation pendant les opérations d'étalonnage, et le système d'étalonnage comprend :

des moyens pour déterminer le nombre d'éléments photosensibles détectant la caractéristique de grossissement ; et des moyens pour comparer le nombre actuel d'éléments photosensibles détectant la caractéristique de grossissement à une valeur de référence afin de déterminer une constante de grossissement pour mémorisation dans la mémoire, d'où il résulte que les représentations électriques produites par le réseau des capteurs sont également traitées en conformité avec cette constante de grossissement mémorisée pour étalonner le grossissement dans le dispositif d'analyse.

6. Dispositif d'analyse selon l'une quelconque des revendications précédentes, comprenant une source de lumière (16) pour éclairer la cible détectable par capteur, et une lentille de focalisation (44) pour focaliser la lumière provenant de la cible sur le réseau des capteurs, la lentille étant déplaçable pour faire varier le foyer des rayons lumineux ; dans lequel la cible détectable par capteur comporte une caractéristique de focalisation pour utilisation pendant les opérations d'étalonnage et le système d'étalonnage comprend :

des moyens pour déterminer le nombre de capteurs détectant la caractéristique de focalisation, et l'intensité de la lumière provenant de la caractéristique détectée comme une indication du foyer à toute position sélectionnée ; une mémoire temporaire pour mémoriser les indications de focalisation à des positions successives sélectionnées de la lentille de focalisation entre le réseau de capteurs et l'image cible pour déterminer la position obtenant l'indication de foyer optimale pour mémorisation dans la mémoire, et des moyens pour déplacer la lentille à la position mémorisée pour étalonner le foyer dans le dispositif d'analyse.

7. Procédé d'étalonnage d'un dispositif d'analyse de trame d'entrée pour détecter une image sur une surface présélectionnée, le dispositif d'analyse comprenant un ensemble chariot (30) pour supporter l'image ; un réseau de capteurs photo-électriques linéaire (40) comprenant une multitude d'éléments photosensibles discrets disposés suivant un premier axe pour détecter l'image (12) supportée par l'ensemble chariot et pour produire des représentations électriques de celle-ci ; et une cible détectable par capteur (62) supportée par l'ensemble chariot, qui comporte une caractéristique d'alignement (70) pour utilisation pendant l'opération d'alignement ; le procédé étant caractérisé par les étapes consistant à :

déplacer l'ensemble chariot suivant un second axe transversal au premier axe ;

mesurer la distance parcourue par la cible à partir d'un point de départ suivant le second axe jusqu'à ce que le capteur détecte la caractéristique d'alignement ;

comparer la distance mesurée à une valeur de référence ;

mémoriser une valeur représentative de la comparaison de distance dans une mémoire, et

traiter les représentations électriques produites par le réseau des capteurs en conformité avec la valeur mémorisée afin de produire un signal image à partir de laquelle l'effet de ce décalage a été éliminé pour étalonner le dispositif d'analyse suivant le second axe.

8. Procédé selon la revendication 7, comportant les étapes consistant à :

détecter la position d'une caractéristique d'alignement par rapport à la longueur du réseau des capteurs photosensibles ;

comparer la position détectée à une référence ;

mémoriser une valeur représentative de la comparaison des positions dans la mémoire ;

utiliser la valeur mémorisée comme référence de compensation du premier axe, d'où il résulte que les représentations électriques produites par le réseau des capteurs sont également traitées en conformité avec cette valeur de compensation mémorisée pour étalonner le dispositif d'analyse suivant le premier axe.

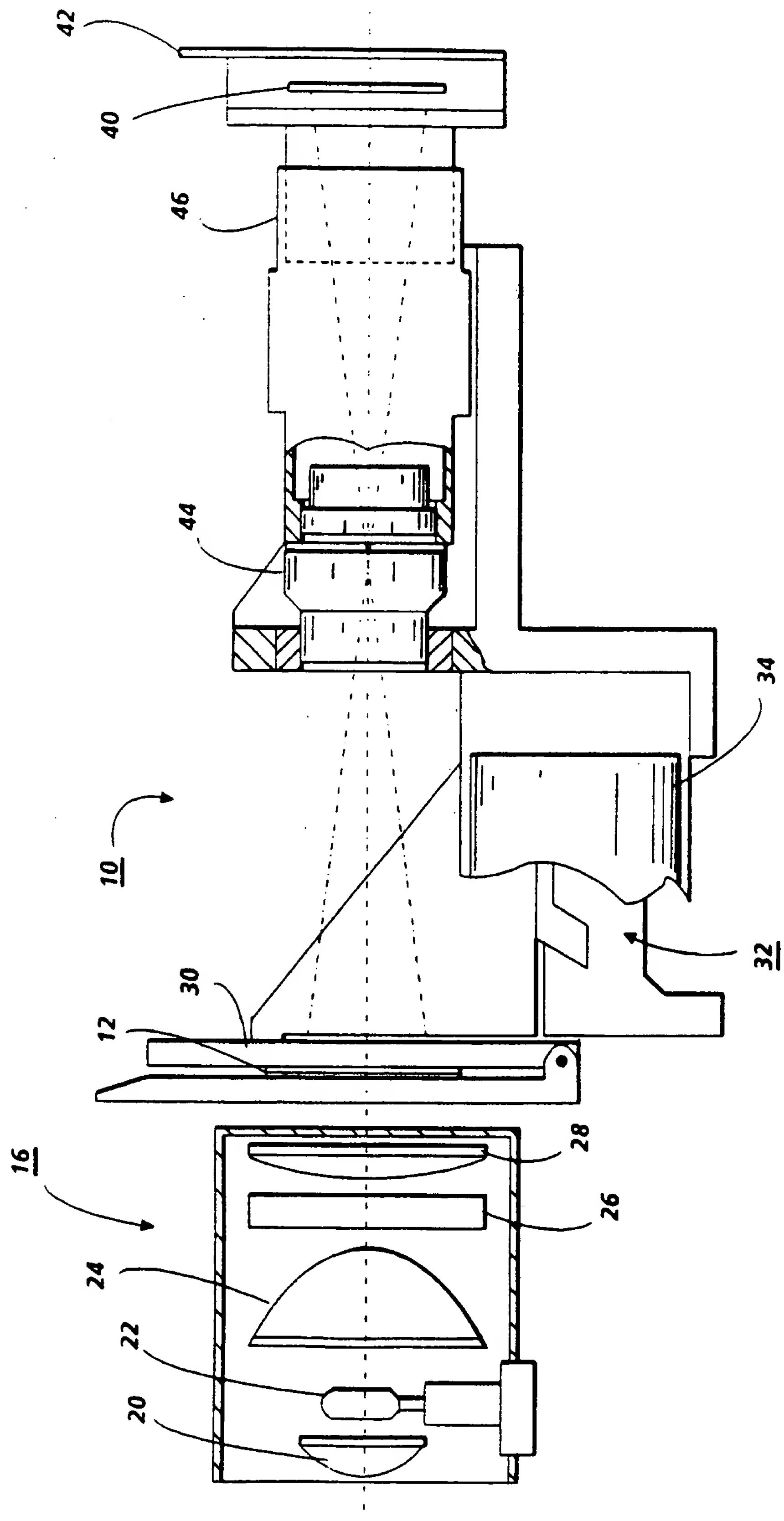


FIG. 1

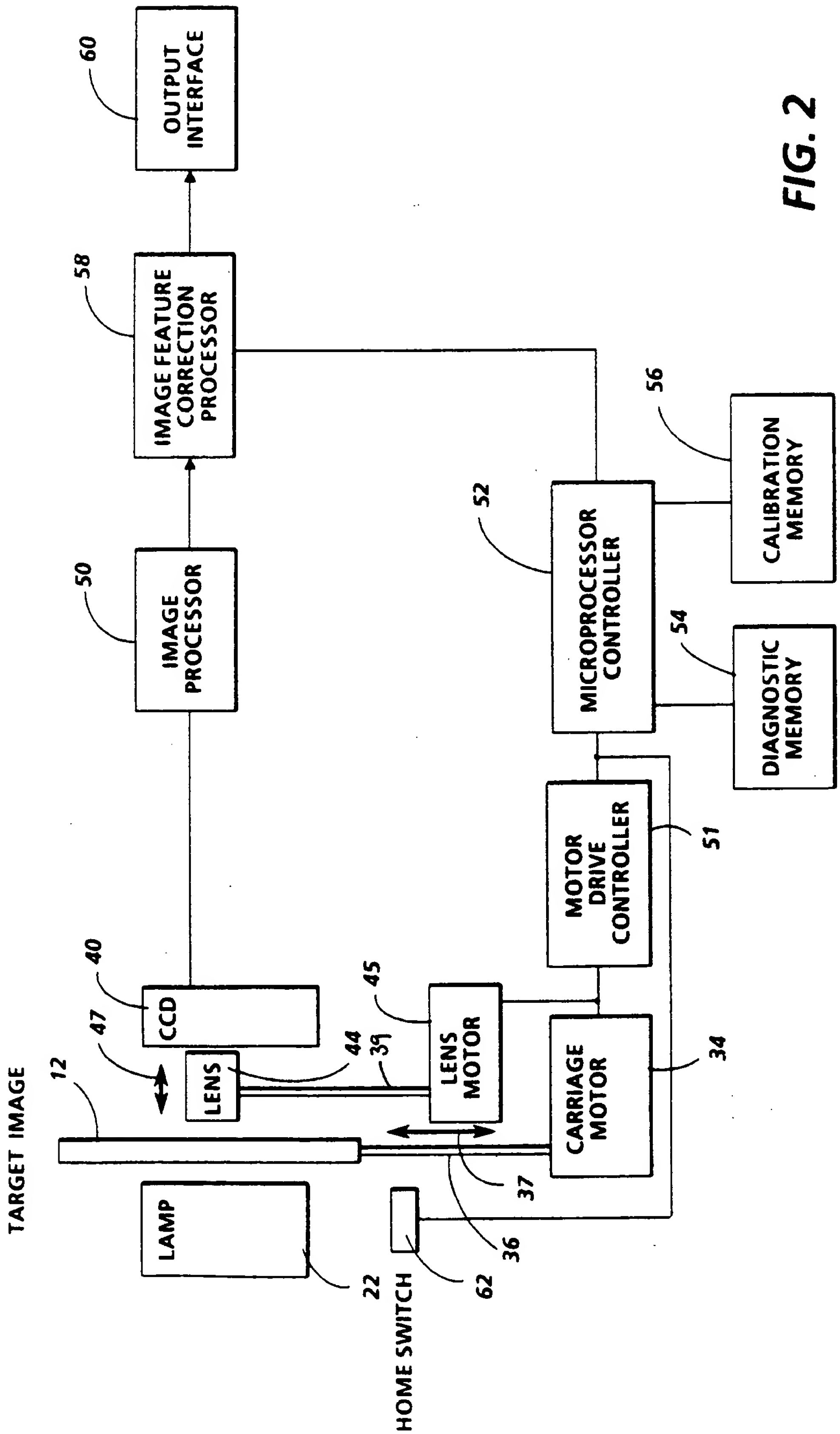

OUTPUT INTERFACE
60
IMAGE FEATURE CORRECTION PROCESSOR
58
IMAGE PROCESSOR
50
MICROPROCESSOR CONTROLLER
52
CALIBRATION MEMORY
56
DIAGNOSTIC MEMORY
54
MOTOR DRIVE CONTROLLER
51
CCD
40
47
LENS
44
39
LENS MOTOR
45
CARRIAGE MOTOR
34
TARGET IMAGE
12
37
36
LAMP
22
HOME SWITCH
62

FIG. 2

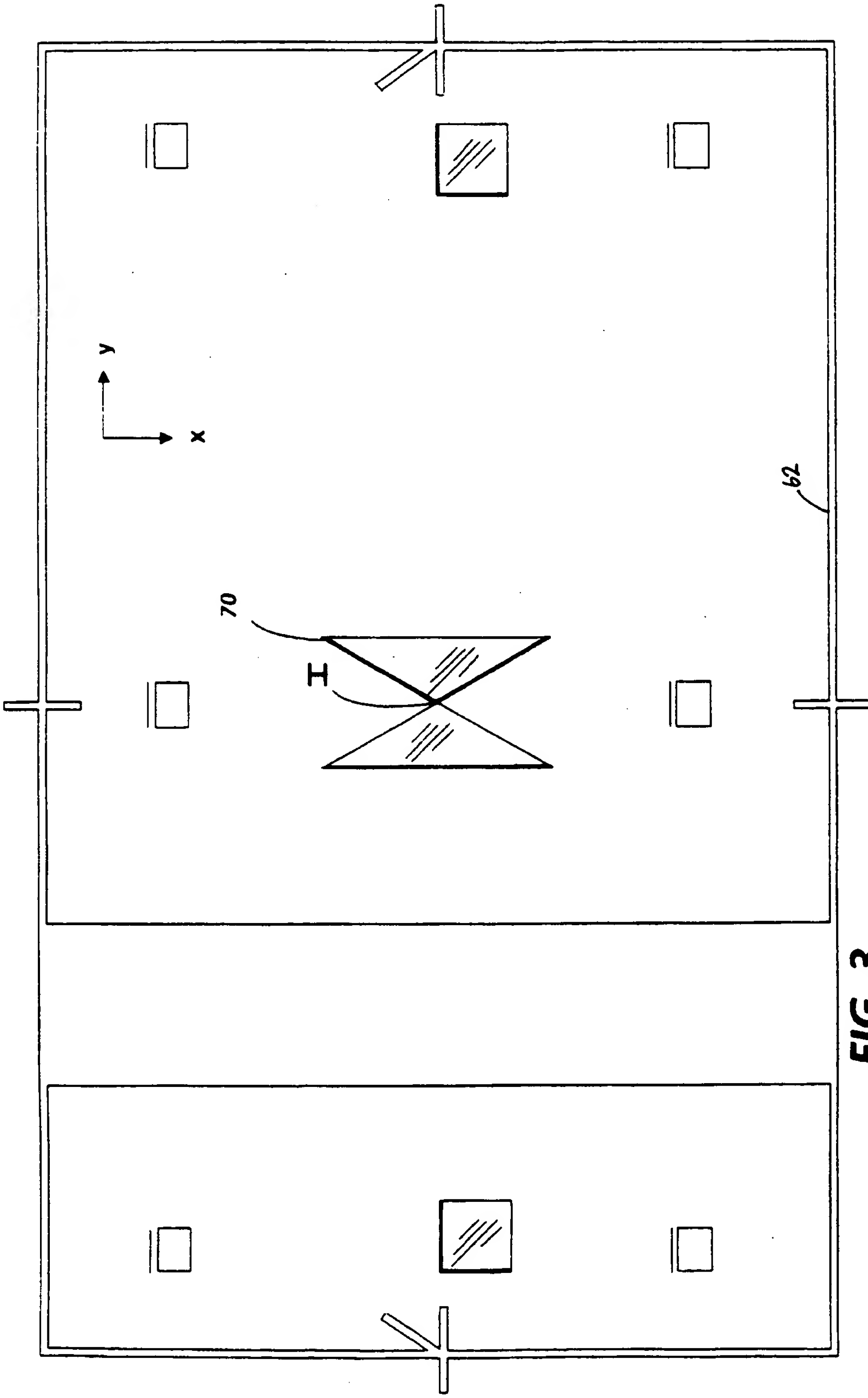
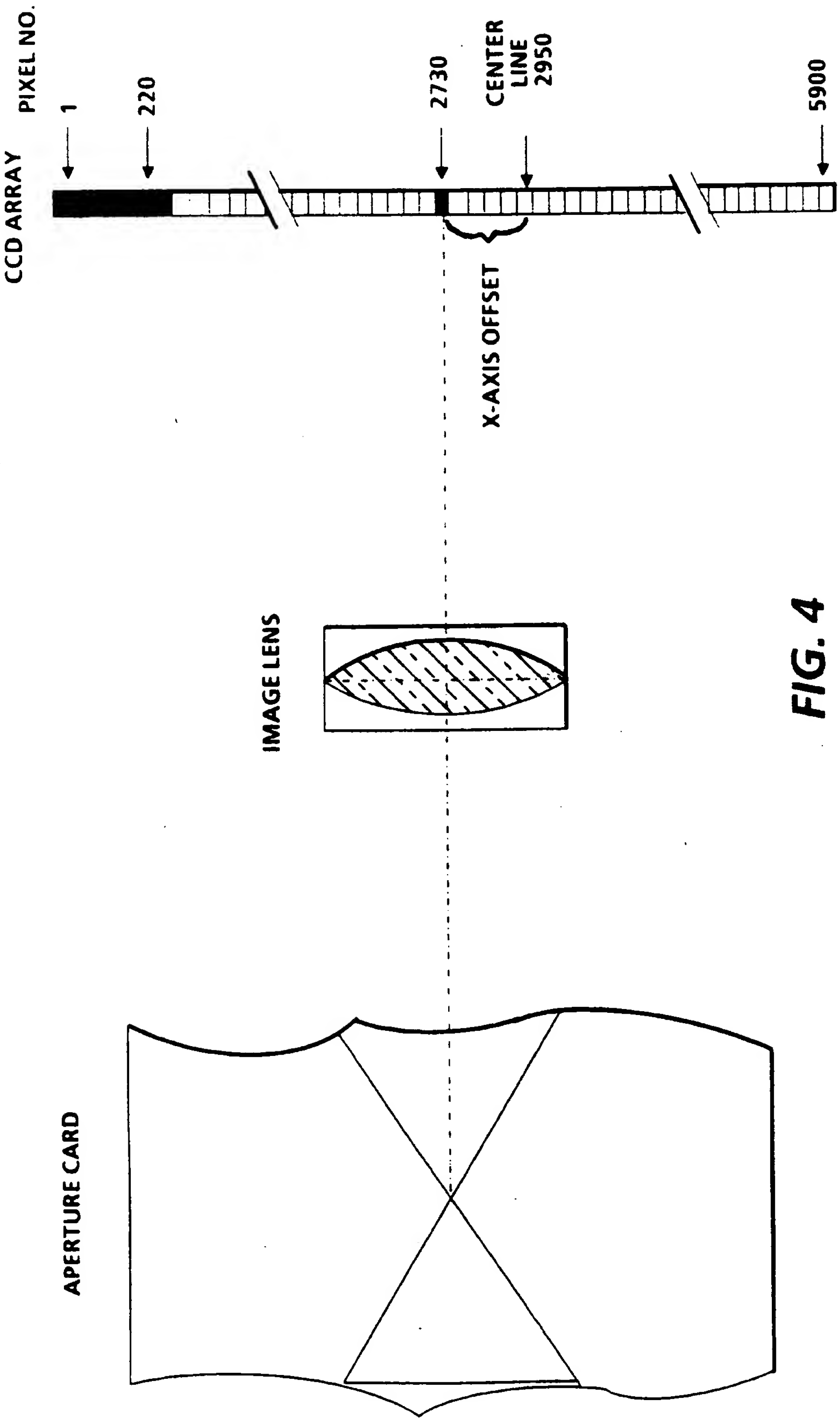


FIG. 3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PIXEL NO.
1
220
2730
CENTER
LINE
2950
5900
X-AXIS OFFSET
IMAGE LENS
APERTURE CARD

FIG. 4